

## Appendix 4: Catalog of NOAA's Observing Systems

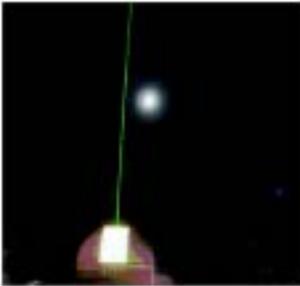
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**NOAA's Observing System Architecture (NOSA) Database** began with an inventory of all NOAA observing systems. Principal investigators for each observing system entered information into common fields. This methodology has allowed for cross-referencing, information sharing, and a concise record of environmental parameters. Appendix 4 is a brief introduction to the vast information contained within the NOSA Database. In the following catalog, the observing systems are arranged alphabetically, by NOAA Line Office.

The principal focus of the data call resulting in this catalog was on observing systems, although some data management and requirements information was collected. NOAA will conduct a NOSA Database update in 2004, focusing on data management systems and those observing systems not captured in the initial data call.



# National Environmental Satellite, Data, and Information Service (NESDIS)



## NESDIS - Doppler Wind Lidar

This system is designed to measure accurate global horizontal wind measurements to improve global and regional numerical weather prediction models and forecasts. Since 1998, NESDIS has sponsored an effort led by the University of New Hampshire to develop and assess the potential of a class of Doppler wind lidars that employ novel optics, high efficiency detectors, and a fiber optic "light recycler" to increase sensitivity and accuracy toward that which would be needed to measure winds from space.

## NESDIS - GOES I/M, N/P, R Geostationary Operational Environmental Satellite, I-M, N-P, R

GOES move in geo-synchronous orbits at an altitude of approximately 35,800 km. They provide a constant vigil for the atmospheric "triggers" for severe weather conditions such as tornadoes, flash floods, hailstorms, and hurricanes. When these conditions develop, these satellites are able to monitor storm development and track storm movements. GOES satellite imagery is also used to estimate rainfall during thunderstorms and hurricanes for flash flood warnings, as well as estimate snowfall accumulations and overall extent of snow cover. Such data help meteorologists issue winter storm warnings and spring snowmelt advisories. Satellite sensors also detect ice fields and map the movements of sea and lake ice, and monitor the space environment around the satellite.



*Artist conception of GOES by Allan Kung.*



## NESDIS - MOBY Marine Optical Buoy

MOBY is a moored bio-optical buoy that measures downwelling irradiance and upwelling radiance in the ocean's surface waters. Measurements are collected coincident with ocean color satellite overpasses on a daily basis.

**NESDIS - NPOESS Integrated Program Office - NPOESS  
National Polar-orbiting Operational Environmental Satellite System**

NPOESS is a low Earth orbit spacecraft remote sensing platform, hosting up to 14 sensors. It will acquire meteorological, environmental, and associated data, including information on cloud imagery, atmospheric profiles of temperature and moisture, and other specialized meteorological, terrestrial, oceanographic, climatic, and solar-geophysical data. It will also provide support to an international search and rescue mission.

**NESDIS - NPOESS Integrated Program Office - NPP  
NPOESS Preparatory Project**

Environmental remote sensing system used for passive remote sensing of visible, infrared, and microwave radiation. First availability: March 2007. First launch: October 2006. Satellite mission duration: 7 years.

**NESDIS - POES  
Polar-orbiting Operational Environmental Satellite**

[PICTURE BAR, below]

The POES satellite mission provides polar-orbiting platforms to support the environmental observations for imaging and measurement of Earth's atmosphere, its surface, and cloud cover. This includes Earth radiation, atmospheric ozone, aerosol distribution, sea surface temperature, vertical temperature and water profiles in the troposphere and stratosphere; measurement of proton and electron flux at orbit altitude; remote platform data collection; and the Search and Rescue Satellite-Aided Tracking (SARSAT) system. Additionally, POES satellite systems support dedicated microwave instruments for the generation of temperature, moisture, surface, and hydrological products in all weather conditions.



**NESDIS - USCRN  
U.S. Climate Reference Network**

The USCRN Program addresses the climate community's requirements regarding long-term (50+ years) high quality, well documented, climate-related surface air temperature and precipitation observations free of time-dependent biases. This is the first "climate driven" observing network designed for the specific purpose of climate quality observations.

*NOAA-M (polar-orbiting operational environmental satellite) from artist conception to first image received after launch.*





## National Marine Fisheries Service (NMFS)



### NMFS - CREWS

#### Coral Reef Early Warning System

Moored buoys, subsurface platforms, and drifting buoys provide oceanographic and meteorological observations in and around the tropical coral reefs of the U.S. Pacific Islands. The drifting and moored buoys telemeter their data in near real-time. The data are used for monitoring conditions and alerting researchers to high stress levels at coral reefs.

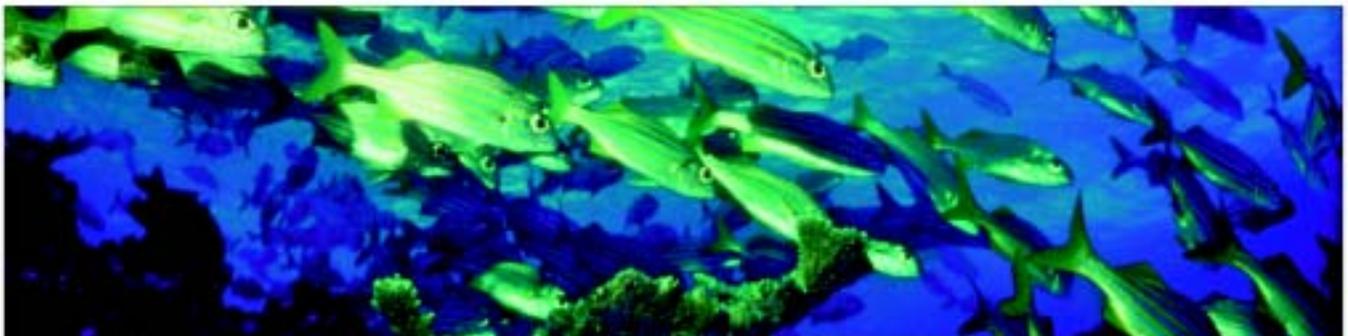


### NMFS - Fishery Dependent Commercial Statistics

This system tracks harvesting of renewable marine resources by U.S. commercial fishing fleets operating throughout the world. Landed weight and value is recorded on a vessel trip basis.

### NMFS - Habitat Assessment

These assessments involve characterization and mapping of coastal habitats important to NOAA trust resources by NOAA vessels and other means.





**NMFS - LMR Surveys**  
**Living Marine Resource and Ecosystem Surveys**  
NOAA conducts ship-based surveys to provide information on the abundance and distribution of living marine resources and their ecosystems in the U.S. Exclusive Economic Zone.

*NOAA Ship David Starr Jordan is one of several NOAA ships that conduct living marine resource and ecosystems surveys.*



**NMFS - MRFSS**  
**Marine Recreational Fisheries Statistics Survey**

The MRFSS is a multi-phase national survey of saltwater recreational fishing, providing data for use in building sustainable fisheries.

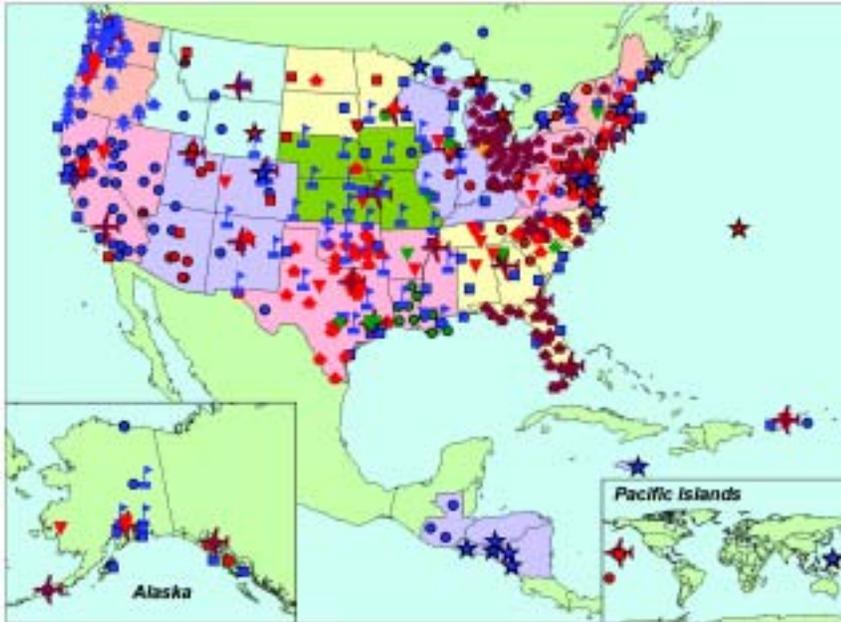


**NMFS - NOP**  
**National Observer Program**  
NOAA deploys fishery observers to collect catch data from U.S. commercial fishing and processing vessels. Approximately 20 different fisheries are monitored by NOP annually. NOP works toward improvements in data collection, observer training, safety, outreach, and the integration of observer data with other research.

**NMFS - Protected Resources Surveys**  
NOAA collects biological and ecological information to identify populations of protected species and to assess the status of each population and the impacts of human activities upon protected species.



## National Ocean Service (NOS)



### NOS - CORS

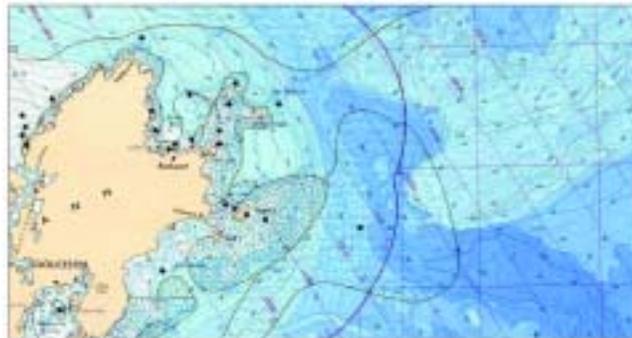
#### Continuously Operating Reference Stations

NOAA coordinates a network of continuously operating reference stations (CORS) that provide Global Positioning System (GPS) carrier phase and code range measurements throughout the U.S. and its Territories. Surveyors, GIS/LIS professionals, engineers, scientists, and others can apply CORS data to position points at which GPS data have been collected. The CORS system enables positioning accuracies that approach a few centimeters relative to the National Spatial Reference System, both horizontally and vertically. New sites are evaluated for inclusion according to established criteria.

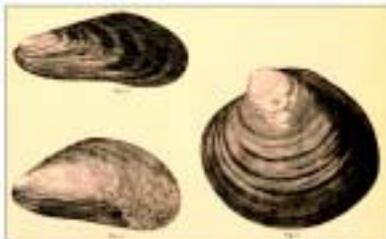
*CORS coverage, December 2003. Symbol color denotes sampling rates: brown, 1 second; red, 5 seconds; yellow, 10 seconds; green, 15 seconds; blue, 30 seconds.*

### NOS - Hydrographic Surveying

The principal objectives of hydrographic surveys are data collection and data compilation for nautical charts. Hydrographic survey data support a variety of maritime functions including port and harbor maintenance (dredging), coastal engineering, coastal zone management, and offshore resource development. The primary datum associated with all hydrographic surveys is water depth. However, there is also considerable interest in sea-floor composition due to implications for anchoring, dredging, structure construction, pipeline and cable routing, and fisheries habitat.



*Portion of a hydrographic survey chart showing bathymetry in the region of Gloucester, Massachusetts.*



### NOS - National Status and Trends Mussel Watch

National Status and Trends Mussel Watch monitors chemical contaminants in sediments and bivalve mollusks (e.g., mussels and oysters). Data can be used to determine which coastal regions are at greatest risk in terms of environmental quality. Presently, bivalves are collected every other year and sediments about every fifth year at a network of more than 250 U.S. coastal and estuarine sites.

*NOAA Ship Rainier is one of several NOAA ships that conduct coastal hydrographic survey operations.*



**NOS - NCOP**

**National Current Observation Program**

The National Current Observation Program updates the tidal current prediction tables and products provided by NOAA to the public. The current tables contain predictions for more than 2,700 locations throughout the country.

**NOS - NWLON**

**National Water Level Observation Network**

The NWLON is a coastal observing network of 175 stations nationwide, including the Great Lakes and Pacific as well as Atlantic Ocean Island Territories and Possessions. The primary purpose is to collect continuous long-term water level observations to a known vertical reference. Data are used for computing tide and water level datums, creating tide prediction tables, and estimating sea level trends. The observations are used in real time for the PORTS® programs as well as for storm surge and tsunami events. Ancillary meteorological and water temperature data are also provided from several locations.

**NOS - PORTS**

**Physical Oceanographic Real-Time System**

PORTS® is a program that supports safe and cost-efficient navigation by providing ship masters and pilots with accurate real-time information required to avoid groundings and collisions. This technological innovation has the potential to save the maritime insurance industry from multi-million dollar claims resulting from shipping accidents. PORTS® includes centralized data acquisition and dissemination systems that provide real-time water levels, currents, and other oceanographic and meteorological data from bays and harbors to the maritime user community. PORTS® provides nowcasts and predictions of these parameters with the use of numerical circulation models.



**NOS - SWMP**

**National Estuarine Research Reserve System-Wide Monitoring Program**

The National Estuarine Research Reserve System (NERRS) System-Wide Monitoring Program (SWMP) tracks short-term variability and long-term changes in coastal ecosystems. The initial phase of the program began in 1996. This phase focuses on monitoring a suite of water quality and atmospheric information. Future phases will monitor organisms and the changes in land use/habitats. The reserves represent nearly 1,000,000 acres of protected estuarine waters, wetlands and uplands from the five major coastal regions in the United States (West Coast, Northeast and Great Lakes, Mid-Atlantic Coast, Southeast Coast, and the Gulf of Mexico and Caribbean Sea).

## National Weather Service (NWS)



### NWS - ARC, LARC

#### ARC: Automated Remote Collector

The ARC collects data in near real time from a point deemed important by a service hydrologist. A data logger collects a specified set of hydrometeorological parameters from colocated instruments and transmits the data using GOES telemetry. These data support short-term forecast and warning operations.

#### LARC: Limited Automated Remote Collector

The LARC acquires data from stage and/or precipitation sensors. The LARC is interrogated via telephone and data are made available to users.



### NWS - ASOS

#### Automated Surface Observing System

The ASOS is a fully automated weather observing system. The system provides meteorological information to a wide variety of users.



*Examples of 6-meter boat-shaped buoy and 3-meter discus buoy.*

### NWS - BUOY

#### National Data Buoy Center (NDBC) Moored Buoy

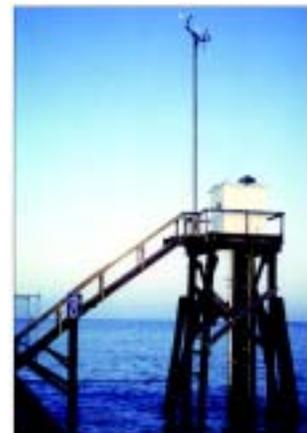
These are floating buoys, moored at specific locations, but able to drift up to approximately 2 miles in all directions, depending upon water depth, due to slack in the mooring. The mast attached to the deck contains sensors to automatically measure meteorological and oceanographic parameters. Antennas and power panels provide power and communications capabilities via NOAA's GOES system.

*C-MAN station, Dauphin Island, Alabama.*

### NWS - C-MAN

#### Coastal-Marine Automated Network

C-MAN stations are fixed platforms in the coastal zone (land-based or in the water) that measure and report marine weather observations in real time at least once per hour. C-MAN stations may be mounted near piers, on lighthouses, and other platforms with good exposure.





*Instrumentation,  
and COOP volunteer.*

**NWS - COOP  
Cooperative Observer Program**

The Cooperative Weather Observer Program (COOP) is the Nation's largest and oldest weather network. It was established under the Organic Act of 1890 to formalize the collection of meteorological and climate observations in the U.S. COOP observations are collected by nearly 12,000 volunteer citizens and institutions.

**NWS - DART  
Deep Ocean Assessment and Reporting of Tsunamis**

The DART system consists of a bottom pressure recorder (BPR) located on the sea floor capable of detecting a tsunami as small as 1 centimeter high on the ocean surface. A discus-shaped buoy, 2.5 meters in diameter, is moored at a position close enough to receive data via acoustic link from the BPR. After receiving data from the BPR, the surface buoy relays the information via NOAA's GOES system to ground stations. The ground stations demodulate the signals and disseminate information to NOAA Tsunami Warning Centers (TWC) and the Pacific Marine Environmental Laboratory. TWCs use the data in real time to decide what U.S. coastal communities need to be warned of impending danger from a tsunami.

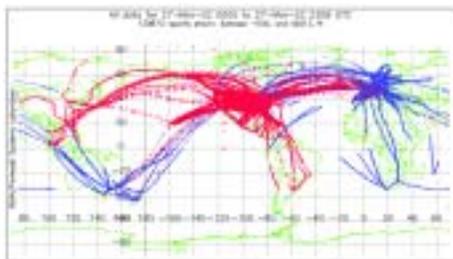
*DART buoy, NOAA Ship  
Ronald H. Brown in  
background.*



**NWS - FNP  
Fischer and Porter Gage**  
The Fischer and Porter gage is used to collect and record precipitation data.



**NWS - LTG  
Lightning Detection**  
A network of sensors detects cloud-to-ground lightning strikes over the conterminous U.S. and 250 km off shore.



**NWS - MDCRS  
Meteorological Data Collection and Reporting System**

MDCRS is a data set from commercial aircraft providing detailed information on the vertical structure of winds and temperature during aircraft ascent, descent, and en-route. The data provide high resolution spatial and temporal atmospheric soundings and enroute data.

*MDCRS global coverage  
from 2000–2002.*



**NWS - NEXRAD  
Next Generation Weather Radar**

WSR-88D systems acquire and process Doppler weather radar data. Forecasters and hydrologists use these data to prepare weather and flood forecasts, watches, and warnings. NEXRAD is also used to aid the safety of public and military aviation operations.

*National Weather Service office, Morristown, Tennessee, with Doppler radar installation.*

**NWS - Profiling Radar - Alaska Network**

Measures vertical profiles of horizontal wind speed and direction from near Earth's surface to above the tropopause.



**NWS - Rawinsonde**

The NOAA Rawinsonde network provides profiles of pressure, temperature, relative humidity, and winds from the surface to more than 30 km high. These data are collected from balloon-borne radiosondes.

**NWS - Regional Surface**

[PICTURE BAR, below]

These are a compilation of various, regional observing systems or sensors that support goals of the NWS such as forecasts and warnings. In most cases the basic parameters such as temperature, winds, and precipitation are available.



**NWS - VOS**

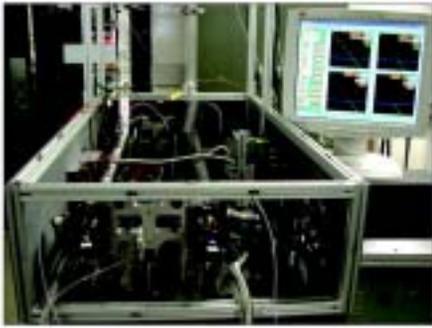
**Voluntary Observing Ship Program**

The VOS Program obtains weather observations from vessels and ships traveling in the normal course of their business. The program relies on volunteer observers and operates at no monetary cost to the vessel. As an international program under World Meteorological Organization auspices, the VOS Program lists 49 countries as participants. The U.S. program is the largest, with approximately 900 vessels actively participating each quarter.

*The Radiosonde Surface Observing Instrumentation System includes sensors that measure temperature, humidity, winds, and pressure. Left to right: temperature/humidity shield, wind sensor, and data logger.*



## Oceanic and Atmospheric Research (OAR)

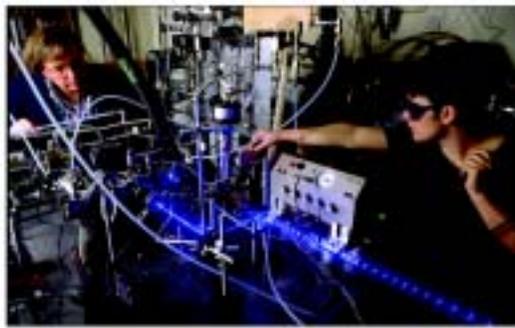


### **OAR - AL - CARDS Cavity Ring-Down Spectrometer**

This new observing capability has enabled observations of difficult-to-measure trace gases such as nitrate radical ( $\text{NO}_3$ ) and dinitrogen pentoxide ( $\text{N}_2\text{O}_5$ ). A 2002 deployment aboard the R/V *Ronald H. Brown* led to the discovery of the important role of nighttime chemistry in the formation of ozone pollution.

### **OAR - AL - CIMS Chemical Ionization Mass Spectrometers**

A new observing capability for atmospheric trace gases that are important players in air-quality chemistry, is deployed on the NOAA WP-3D aircraft to study the processes that are important in regional air quality in the U.S.



### **OAR - AL - Laboratory Systems for Investigation of Chemical Reactions and Processes**

Development of new observing capabilities begins in the laboratory and culminates in field-ready instruments for the measurement of trace gases and particles that are important in air quality, climate, and the ozone layer. Partners within NOAA and in other agencies and academia collaborate in the deployment of a suite of chemical and meteorological instrumentation in focused field studies, using NOAA observing platforms such as the WP-3D aircraft and the R/V *Ronald H. Brown*.

### **OAR - AL - MIDAS Miniaturized Differential Absorption Spectrometer**

This spectrometer is flown on the NOAA WP-3D aircraft and used at ground sites to measure trace gases and their importance in air quality and climate-related processes.

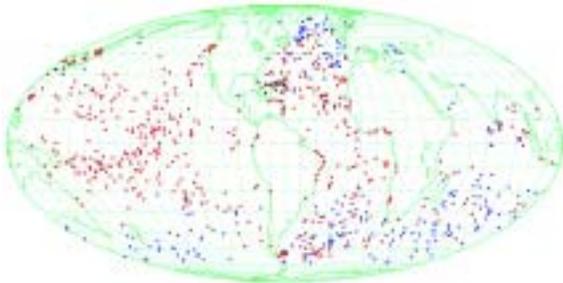
### **OAR - AL - PALMS Particle Analysis by Laser Mass Spectrometry**

The PALMS instrument deciphers the "chemical fingerprint" of individual atmospheric aerosol particles. It has enabled the identification of the subset of atmospheric aerosols that are effective as seed particles for cloud formation, information that is important for climate.

### **OAR - AL - Wind-Profiling and Precipitation-Profiling Radars**

These 915-MHz Doppler radars are used to measure vertical profiles of horizontal wind speed and direction in the lower troposphere. S-band (2835 MHz) Doppler radar systems use backscatter from hydrometeors in the atmosphere to remotely study precipitation parameters. Both contribute to the understanding of climate dynamics and climate variability.





**OAR - AOML - ENSO OS Drifting Buoys**  
**El Niño Southern Oscillation Observing System Drifting Buoys**  
 The purpose is to maintain and support the Global Drifter Array and the Global Drifter Center.

*Plot of Global Drifter Array. There were 848 buoys in 2003.*

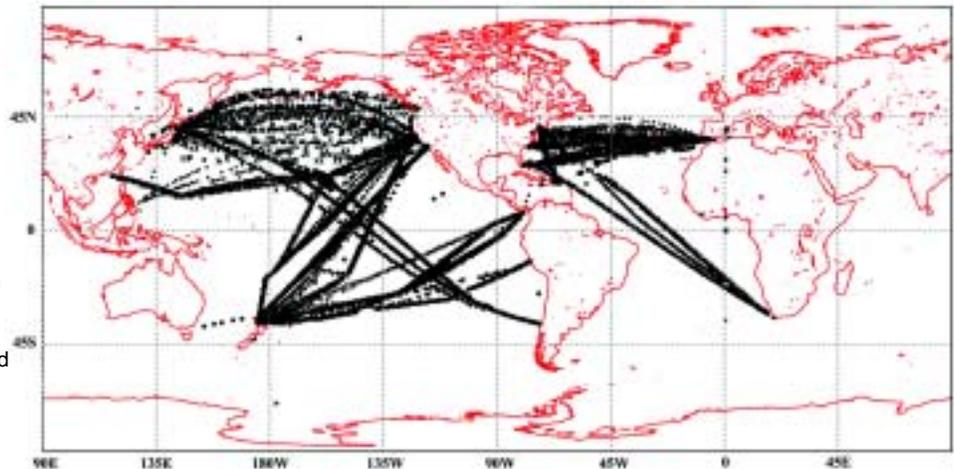
*SEAS - ENSO OS platforms, with more than 11,100 observations in 2002.*

**OAR - AOML - ENSO OS SEAS GOOS/VOS/XBT**

Real time Expendable Bathythermograph (XBT) observations are collected from Voluntary Observing Ships (VOS) in support of the El Niño Southern Oscillation (ENSO) Observing Network and global climate change research.

**OAR - AOML - ENSO OS VOS/XBT El Niño Southern Oscillation Observing System VOS/XBT Network**

The purpose is to maintain and support the global Low Density and Frequently Sampled XBT transects utilizing the Voluntary Observing Ship (VOS) network.



**OAR - Argo Profiling Floats**

Argo is an international program to deploy a global array of 3,000 profiling floats to observe the ocean's upper layer in real time. Along with satellites, the Argo array will initiate the oceanic equivalent of today's operational observing system for the global atmosphere.

**OAR - ARL - Atmospheric Dispersion Measurement System**

This mobile dispersion measurement system uses intentionally-released, harmless tracer gases to directly measure dispersion. The system includes release, sampling, and analysis equipment.



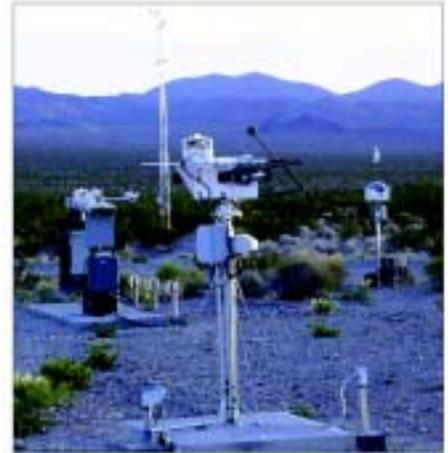


*ISIS, Seattle, Washington.*

**OAR - ARL - ISIS**  
**Integrated Surface Irradiance Study**  
 ISIS is a national network of surface solar irradiance stations representing differing climates of the United States.



**OAR - ARL - Mesonet**  
**INEEL Mesoscale Meteorological Network**  
 Mesonet includes 36 meteorological data collection stations located inside and near the U. S. Department of Energy Idaho National Engineering and Environmental Laboratory.



*SURFRAD station, Desert Rock, Nevada.*

**OAR - ARL - SURFRAD**  
**Surface Radiation Budget Network**  
 SURFRAD is a national network of surface radiation budget stations representing differing climates of the United States.

*AIRMoN-wet site, Bondville, Illinois.*



**OAR - ATDD - AIRMoN**  
**Atmospheric Integrated Research and Monitoring Network**  
 The AIRMoN has two distinct sub-networks, AIRMoN-wet and AIRMoN-dry. AIRMoN-wet monitors the wet deposition of certain key air pollutant species, and AIRMoN-dry does the same for dry deposition. Both have been in operation since the 1980s.

**OAR - ATDD - ETOS**  
**East Tennessee Ozone Study**

ETOS is comprised of a seasonal network of ozone monitors and tower-based meteorological systems to determine local time-varying ozone concentrations at mountain top, ridge top, and valley bottom sites throughout eastern Tennessee. Data are collected by telemetry.

**OAR - ATDD - RAMAN Network**  
**Regional Atmospheric Measurement and Analytical Network**  
 This tower network provides meteorological data from mountain top, ridge top, and valley bottom locations in the complex terrain surrounding Oak Ridge, Tennessee.

*Close-up of ETOS instrument in its shelter, at the base of a tower.*





**OAR - CMDL - AERO  
Aerosol System**

The purpose is to measure aerosol optical properties as a function of size and wavelength at baseline and regional stations.



*Aircraft provide platforms for various NOAA observing systems. This Cessna is used in an aerosol sampling program, Ponca City, Oklahoma.*

**OAR - CMDL - CCGG  
Carbon Cycle Greenhouse Gases**

The NOAA Carbon Cycle Greenhouse Gases group makes ongoing discrete measurements from land and sea surface sites and aircraft, and continuous measurements from baseline observatories and tall towers. These measurements document the spatial and temporal distributions of carbon-cycle gases and provide essential constraints to our understanding of the global carbon cycle.

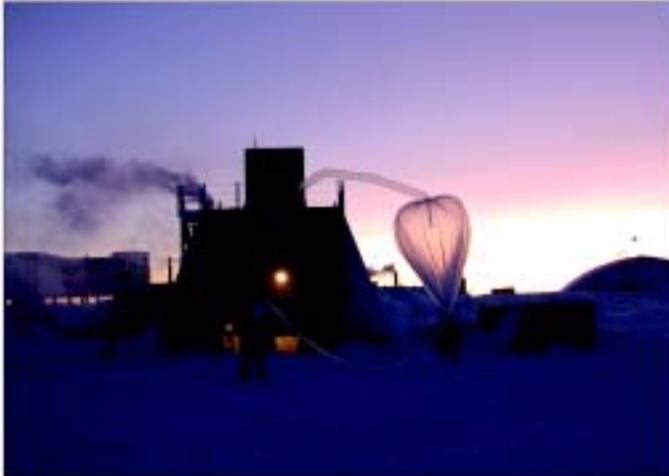


*View of the Mauna Loa Observatory from the sampling tower; CH<sub>4</sub> and CO gas chromatographs at the observatory.*



*Carbon-cycle measurements are compiled from land, sea, and air. NOAA scientists are involved in many international, cooperative programs in these studies. Left to right: Firn gas collection in Greenland; air sampling instrument that flies on research aircraft; planes readied at Raratonga, Cook Islands; sampling over Fortaleza, Brazil.*





*Taking measurements at sunrise, Amundsen South Pole Station, September, 2003.*

**OAR - CMDL - Dobson  
Measurement of Total Column Ozone using the Dobson Ozone Spectrophotometers**

The Dobson Ozone Spectrophotometer has been used to study total ozone since its development in the 1920s. The observations of total ozone (the total amount of ozone in a column from the surface to the edge of the atmosphere) by this instrument is one of the longest geophysical measurements series in existence.

**OAR - CMDL - HATS  
Halocarbons and other Atmospheric Trace Species**

These measurements quantify the spatial and temporal distributions of nitrous oxide and halogen-containing compounds in the atmosphere and the magnitudes of their sources and sinks.

**OAR - CMDL - STAR  
Solar and Thermal Atmospheric Radiation Surface Measurements**

This system quantifies upwelling and downwelling solar and thermal atmospheric radiation as it relates to climate variability. Observations are made at globally remote and climatically diverse locations around the world.



*STAR, Kwajalein Atoll.*

*Trans-Siberian Observations Into the Chemistry of the Atmosphere (TROICA). Scientists from NOAA, the Max Planck Institute for Chemistry, and the Russian Institute of Atmospheric Physics created a mobile laboratory to measure halocarbon and greenhouse gases along the trans-Siberian railway.*





**OAR - ETL - 449 Radar  
449 MHz Wind Profiling Radar**

This is a Wind Profiling and Acoustic Sounding System Radar operating at 449 MHz. The radar can be positioned to observe either in a horizontal or vertical direction. The radar can provide remote sensing anywhere in the world because it is mobile and very powerful.



**OAR - ETL - 5mm Scanning Radiometer**  
The 5-mm Scanning Radiometer scans rapidly (every 1 second) in a vertical plane to derive boundary layer temperature profiles. When operated from a ship, air-sea temperature differences can also be derived.



**OAR - ETL - ABAEL  
Airborne Aerosol Lidar**  
ABAEL uses backscatter lidar for aerosol detection via aircraft platforms.



**OAR - ETL - Airborne Ozone Lidar**  
This system is a laser-based active remote sensor (lidar system) for measuring ozone concentration and aerosol optical backscatter in the lower troposphere.



**OAR - ETL - BAO  
Boulder Atmospheric Observatory**  
The BAO is a 300m research tower measuring winds, temperature, and RH at 5 levels.

**OAR - ETL - Cband Radar (Ron H. Brown)  
NOAA R/V Ronald H. Brown C-band Doppler Radar**  
This C-band Radar is a 5.6 GHz Doppler radar on board the NOAA research vessel, *Ronald H. Brown*. The radar's 4.3 meter antenna is mounted on top of the ship's main mast within a protective radome and is designed for operations in heavy weather up to sea state 8.



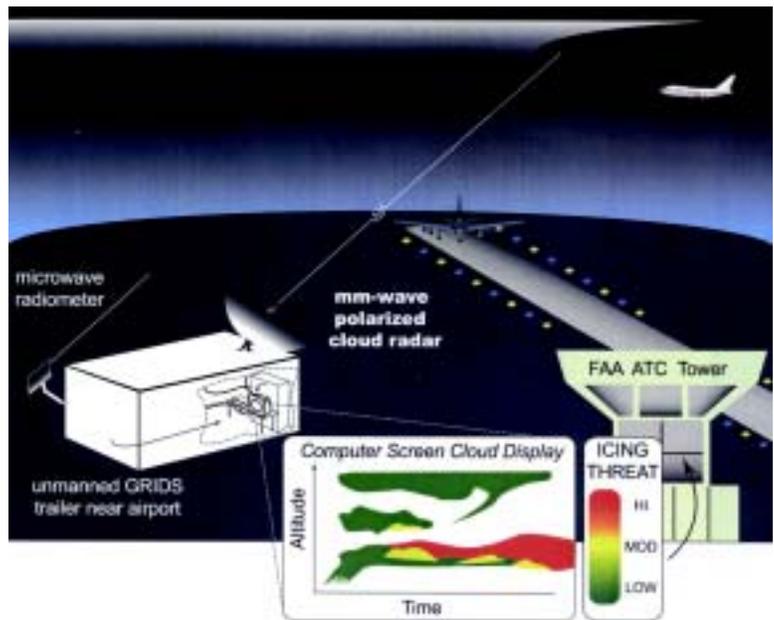


**OAR - ETL - DABUL**  
**Depolarization and Backscatter Unattended Lidar**  
 DABUL is an all-weather lidar (laser radar) for cloud and aerosol detection, including backscatter and depolarization profiles.



**OAR - ETL - Fish Lidar**  
 This airborne system uses green light to profile distributions of scatterers such as plankton and fish in the upper ocean.

**OAR - ETL - GRIDS**  
**Ground-based Remote Icing Detection System**  
 GRIDS is a multi-sensor observing system, developed for the detection of supercooled liquid that would cause icing on aircraft. This system also has applications for cloud physics and climate research, model parameterization and verification, and calibration/validation activities in support of other NOAA activities.



**OAR - ETL - Hughes Radiometer**  
 This is a liquid/vapor radiometer system with added surface meteorological information.



**OAR - ETL - Infrasonic Observatory**  
 This is a system designed to measure atmospheric infrasound primarily in the 0.5 to 10 Hz frequency range.



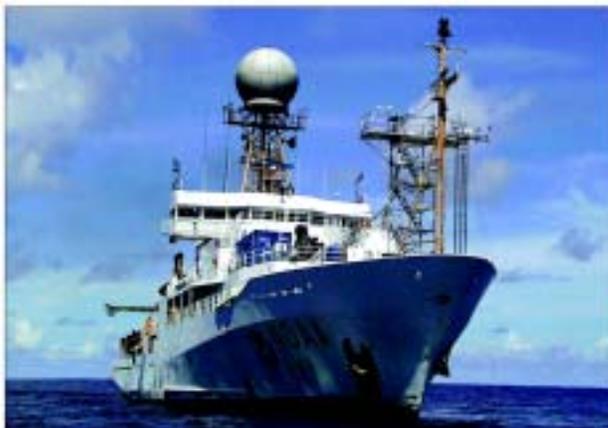
**OAR - ETL - IR Radiometer**  
**OAR - ETL - Narrow Band IR Radiometer**  
 This is an infrared radiation sensor for measuring temperature.

**OAR - ETL - Lidar - HRDL - ost**  
**High Resolution Doppler Lidar**  
 HRDL is a scanning atmospheric Doppler lidar that provides range-resolved measurements of radial wind speed and backscatter intensity. It is designed to make higher spatial and temporal resolution measurements in the atmospheric boundary layer.

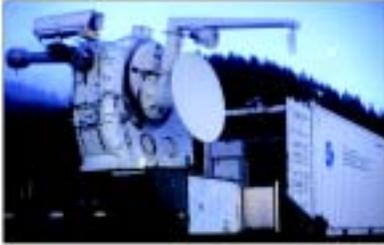


**OAR - ETL - Lidar - MOPA - ost**  
**Dual Wavelength Doppler Lidar**  
 Mini-MOPA is a scanning Doppler lidar used in field campaigns to study atmospheric phenomena in the boundary layer.

**OAR - ETL - Lidar - TEACO - ost**  
**High Power Doppler Lidar**  
 TEACO2 is a scanning atmospheric Doppler lidar that provides range-resolved measurements of radial wind speed and backscatter intensity.



**OAR - ETL - Marine Atmospheric Boundary Layer Observation System**  
 This system is deployed on seagoing ships in order to measure air-sea radiative and turbulent fluxes, boundary layer clouds, temperature, humidity, and wind profiles.



**OAR - ETL - NOAA/K  
Mobile Scanning Cloud Radar**  
NOAA/K is a dual-polarized, scanning, Doppler radar (short wavelength, 8.66 mm/35GHz), for cloud physics research and climate studies.



**OAR - ETL - OPAL  
Ozone Profiling Atmospheric Lidar**  
The Ozone Profiling Atmospheric Lidar (OPAL) observing system provides ozone profiles for the health of the atmosphere and climate change programs. It is used for field campaigns to profile ozone and aerosol backscatter.



**OAR - ETL - Platteville - 915 - Profiler  
Platteville Tropospheric Profiler**  
The Platteville Tropospheric Profiler is a narrow-beam, high-power, radar wind profiler operating at 915 MHz. Recently, it has been upgraded to multi-frequency capability.



**OAR - ETL - Portable Cloud Observatory**  
This system is comprised of a 35 GHz radar, a 3-channel microwave radiometer, and an infrared radiometer packaged in a seatainer. An integral part of the system is a data processing package and a suite of theoretical retrieval techniques that allows real-time production of cloud microphysical and optical properties.



**OAR - ETL - Profiling Radar  
Wind and Temperature Profiling Radar**  
This 915 MHz Doppler radar is used to measure profiles of wind speed and direction in the lower atmosphere.



**OAR - ETL - Profiling Radar -  
Tethered Aerostat Radar System**  
This is a wind and temperature profiling radar operating at 449 MHz.



**OAR - ETL - PSR  
Polarimetric Scanning Radiometer**  
The Polarimetric Scanning Radiometer (PSR) is used for airborne or ground-based microwave radiometric imaging.



**OAR - ETL - Radiometer Container**  
This is a container fitted with microwave and infrared radiometers for the study of clouds.



**OAR - ETL - Radiometrics Radiometer**  
This is a liquid/vapor radiometer system.



**OAR - ETL - Rawinsonde - MW11, MW15, MW21**  
The Rawinsonde MW11, MW15, and MW21 observing systems consist of a sounding system. These systems measure temperature, relative humidity, pressure, wind speed and direction of the atmosphere. They use Global Positioning Systems (GPS) to determine wind speed and direction.



**OAR - ETL - Wind Profiler - RB  
Electronically-Stabilized Wind Profiler**  
This is a 915-MHz clear-air radar used for measuring wind speed and direction from 150 - 3000 m altitude. This system automatically compensates for platform motion.

**OAR - ETL - Sodar  
Wind Profiling Sodar**  
Sodar is a ground-based remote wind profiler which acquires atmospheric boundary layer data.



**OAR - ETL - WVDIAL  
Compact Water Vapor DIAL Lidar**  
This is a compact eye-safe autonomous lidar for profiling water vapor in the lower troposphere.



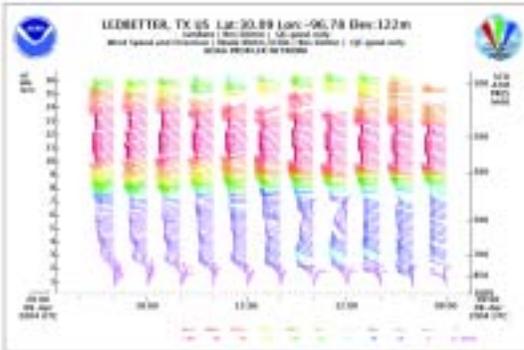
**OAR - FSL - CWOP  
Citizen Weather Observer Program**

Through CWOP, FSL is organizing data collected from citizen weather stations. This could potentially augment the NWS Modernized COOP Program automated surface weather reports.

**OAR - FSL - GPS Water Vapor Sensor  
Global Positioning System Integrated Precipitable Water Sensor**

Integrated (total atmospheric column) precipitable water is retrieved under all weather conditions from excess delays in the GPS radio signals caused by water vapor in the lower atmosphere. The system includes GPS receivers and colocated surface meteorological sensors belonging to NOAA and other Federal government agencies. GPS receivers belonging to State and local government agencies, universities, and the private sector, densify the network to provide additional detail that further improves NOAA short-range weather forecasts.

*A Nationwide Differential GPS (NDGPS) site belonging to the U.S. Department of Transportation.*



*Above, wind speed and direction plot created with MADIS data from Ledbetter, Texas (site at right). Below: Profilers at Syracuse, New York, and Glennallen, Alaska.*

**OAR - FSL - MADIS  
Meteorological Assimilation Data Ingest System**

MADIS is a unique network of more than 13,000 stations. MADIS integrates and quality controls surface meteorological data from mesonets operated by many Federal, State, and local government agencies, public utility companies, research organizations, educational institutes, as well as private individuals and corporations.



**OAR - FSL - CAP  
Cooperative Agency Profilers**

This system measures vertical profiles of horizontal wind speed and direction (and temperature in many cases) in the lower troposphere to lower stratosphere.

**OAR - FSL - NPN  
NOAA Profiler Network**

The NPN measures vertical profiles of horizontal wind speed and direction from near Earth's surface to above the tropopause.





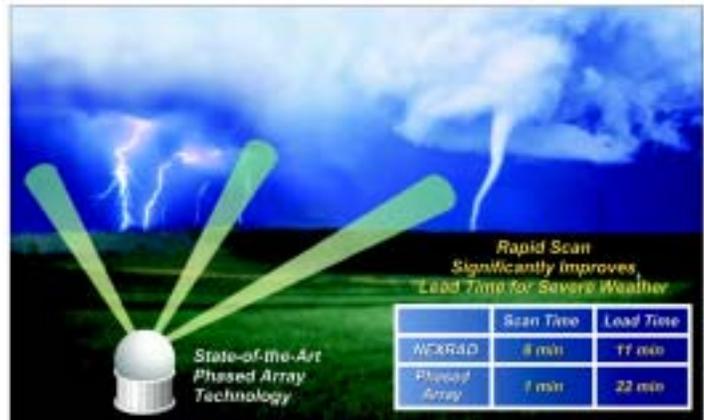
GSLN station, Hululue Island, Maldives.

**OAR - GSLN  
Global Sea Level Network**

GSLN stations are fixed platforms on islands and in the coastal zone that measure and report sea level information in real time using geostationary satellites and the Global Telecommunication System. GSLN provides global sea level information for use in multiple NOAA missions including climate monitoring and prediction, and studies of climate phenomena such as ENSO.

**OAR - NSSL - Phased Array Radar**

This system adapts SPY-1 radar technology (currently deployed on U.S. Navy ships) for use in spotting severe weather. The phased array radar system technology has the potential to vastly improve the NEXRAD system (high resolution Doppler radar).

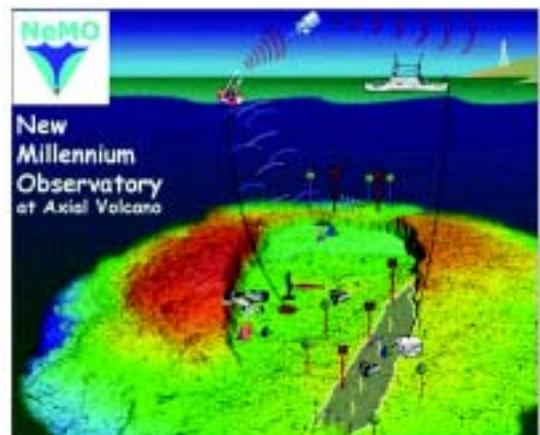


**OAR - PMEL - FOCI  
Fisheries Oceanography  
Coordinated Investigations**

This system takes physical and biological marine measurements in the Bering Sea, Gulf of Alaska, and North Pacific Ocean. The system includes moorings, drifters, tows, and surveys.

**OAR - PMEL - NeMO Net  
New Millennium Observatory Network**

NeMO examines the relationship between volcanic events, chemistry of seafloor hot springs, and the biological communities that depend on them. The site is at the Axial Seamount on the Juan de Fuca Ridge, 250 miles off the coast of Oregon and Washington. An acoustic modem links seafloor instruments to a surface buoy and then data are relayed to shore by satellite.



**OAR - PMEL - Ocean Acoustic Monitoring System**

[ PICTURE BAR, below ]

The Ocean Acoustic Monitoring System consists of arrays of underwater hydrophones, both autonomous and cabled, deployed at numerous sites around the global ocean, that collect continuous digital acoustic data for ocean observation.



**OAR - PMEL - PIRATA**

**Pilot Research Moored Array in the Tropical Atlantic**

PIRATA studies ocean-atmosphere interactions in the tropical Atlantic that are relevant to regional climate variability on seasonal, interannual, and longer time scales. The project is implemented through multi-national cooperation.

**OAR - PMEL - TAO**

**Tropical Atmosphere Ocean Array**

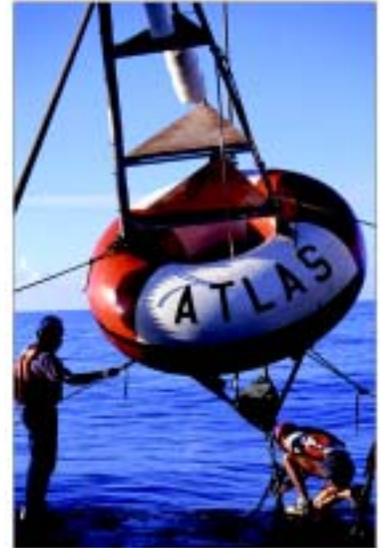
The array is a major component of the El Niño Southern Oscillation (ENSO) Observing System, the Global Climate Observing System (GCOS), and the Global Ocean Observing System (GOOS). Support is provided primarily by the United States (NOAA) and Japan (Japan Marine Science and Technology Center), with additional contributions from France (Institut de recherche pour le developpement).



**OAR - Stratus**

**Long-term Evolution of the Coupled Boundary Layers**

The Stratus project is obtaining a reliable multi-year dataset of meteorological and subsurface measurements beneath the coast of Chile and Peru. Moorings are put in place for one year, and then retrieved and replaced with another, similar mooring. The buoys have meteorological systems that measure wind speed, wind direction, air temperature, sea surface temperature, barometric pressure, relative humidity, incoming shortwave radiation, incoming longwave radiation, and precipitation. Subsurface instruments attached to the mooring line measure water temperature, conductivity, current speed, current direction, salinity, and precipitation (acoustic rain gauge).



*Ocean Acoustic Monitoring System. Left to right: Hydrophone is deployed from the French vessel Le Suroit. The mooring is designed to place the hydrophone within the oceanic sound channel. NOAA and French researchers acoustically interrogate the newly deployed mooring to refine its position.*

